What is claimed is:

1. A spray data acquisition system comprising:

a housing for supporting a pumping device whereby the pumping device is responsive to an applied force to generate an aerosol spray plume through an exit port thereon along a spray axis;

a spray pump actuator, wherein the spray pump actuator is capable of controlling a pumping force and a duration of the aerosol spray plume of the pumping device;

an illumination device for illuminating the aerosol spray plume along at least one geometric plane that intersects the aerosol spray plume; and,

an imaging device for acquiring data representative of a first interaction between the illumination and the aerosol spray plume along the at least one geometric plane.

2. An apparatus for producing image data representative of at least one sequential set of images of a spray plume, each of the images being representative of a density characteristic of the spray plume (i) along a geometric plane that intersects the spray plume, and (ii) at a predetermined instant in time, comprising:

an illuminator for providing an illumination of the spray plume along at least one geometric plane that intersects the spray plume; and,

a transducer for generating the image data representative of an interaction between the illumination and the spray plume along the at least one geometric plane.

3. An apparatus according to claim 2, wherein the sequential set of images is representative of a progression in time.

4. An apparatus according to claim 2, wherein a first time-sequential set of images corresponds to an axial cross-sectional density characteristic along a first geometric plane substantially normal to a flow direction centerline, and a second time-sequential set of images corresponds to a longitudinal density characteristic along a second geometric plane substantially parallel to and intersecting the flow direction centerline.

5. An apparatus according to claim 2, wherein the interaction between the illumination and the spray plume includes optical scattering.

6. An apparatus according to claim 2, wherein the interaction between the illumination and the spray plume includes optical absorption.

7. An apparatus according to claim 2, wherein the transducer includes a digital imaging system for generating and recording the image data

8. An apparatus according to claim 7, wherein the digital imaging system includes an image sampling rate of approximately 500 images per second.

9. An apparatus according to claim 2, wherein the illuminator includes a laser system having a fan-shaped output pattern.

10. An apparatus according to claim 9, wherein the fan-shaped output pattern includes a fan angle of approximately 45 degrees, and a laser line thickness of approximately one millimeter at approximately the centerline of the emitted spray.

11. An apparatus according to claim 9, wherein the laser system includes a 4 watt, 810 nm laser output.

12. A spray data acquisition system according to claim 1, wherein the illumination device illuminates the spray plume along a second geometric plane that intersects the aerosol spray plume, and the imaging device acquires data representative of a second interaction between the illumination and the aerosol spray plume along a second geometric plane.

13. A spray data acquisition system according to claim 12 wherein the first and the second geometric planes are substantially orthogonal.